My paper discusses system consequence, which is a central idea in the project to lift the theory of information flow to the general level of universal logic and the theory of institutions. At the same time, it uses ideas from information flow to extend the theory of institutions.

Talk

- **Introduction**
  Main Concepts: The main concepts are information systems, information channels, information flow (direct/inverse) and system consequence. An information system might represent the distributed information resources of a scientific community. An information channel then represents the information flow architecture, which allows the various parts of the system to interact.
  A Conference Analogy: The ICCS'09 conference is an example that illustrates these concepts. The conceptual structures community is a scientific community with distributed information resources (information system). Each member brings to the conference their own knowledge and expertise, and the conference itself allows for the fusion of these ideas (direct flow along an information channel). Each member takes home with themselves an increased understanding of the issues (inverse flow along an information channel).
- **Metatheory**
  Information Flow `IF`: The theory of information flow is the logic of distributed systems. The goal is to describe the concept of an information channel. The core concept is classification between instances and types; the core property is invariance of classification under adjoint instance-type flow. The main concepts are classifications (formal contexts), infomorphisms, theories of sequents (specifications), (local) logics, distributed/information systems, information flow and distributed logic (system consequence).
  Institutions `INS`: The theory of institutions is abstract model theory: the core concept is satisfaction between the structures and sentences indexed by an underlying language; the core property is invariance of satisfaction under adjoint structure-sentence flow along a language morphism. There are many important examples of institutions including equational logic, first order logic, information flow and sketches.
- **Compatibility**
  `INS` generalizes `IF`: The theory of information flow has an associated institution. Extend classification from types to sequents (sentences). For every type set (language), define satisfaction between classifications (structures) having that type set and sequents on that type set. For every type function (language morphism), define the inverse flow of classfications and the direct flow of sequents. Then, verify the invariance of satisfaction.
  `IF` extends `INS`: Some mathematical contexts have both a heterogeneous and a homogeneous aspect. The heterogeneous aspect is called an indexed context — here indexes are mapped to objects. The homogeneous aspect is called a fibered context — here indexes are combined with objects. We picture and describe the heterogeneous/homogeneous alternatives in terms of disjoint unions. An institution has several interelated heterogeneous/homogeneous mathematical contexts: structures (models), specifications and logics (general, sound and composite). Fibered context morphisms generalize concept lattice order.
- **Systems**
  General Systems: A system consists of a collection of interconnected elements or parts. Parts are connected by constraint links. Systems have shape and are embedded within an ambient mathematical context. A system morphism links two systems together, a source system to a target system; it consists of a collection of flow links connecting respective parts. Flow links are required to naturally translate constraint links.
  Information Channels in an Institution: A distributed system is a system over the context of languages (formal) or the fibered context of structures (semantic). An information system is a system of information resources — a collection of specifications (formal) or logics (semantic) over a distributed system, where a constraint link between objects (whether specification or logic) means source generality over target.
- **Flow**
  Information Flow in an Institution: Within an institution there is atomic, molecular and systemic flow of information. Atomic and molecular flow is along morphisms (language morphisms when formal and structure morphisms when semantic). Systemic flow is along information channels. Atomic objects are sentences or structures, molecular objects are specifications or logics, and systemic objects are information systems (formal or semantic).
  System Consequence in an Institution: System consequence is defined on an information system along an information channel — the composition of direct and inverse information flow. There are two increasingly special cases of information channel: optimal channels (summing along a shape or indexing passage) and absolute channels (with trivial indexing passage). System consequence is a closure operator. Consequence along a composite channel is more specialized than along the first component. Consequence along an optimal channel is most specialized when the channel is absolute. Consequence of sound system is restriction of consequence of inclusion. Restriction of consequence specializes (strictly?) consequence of restriction.
- **Conclusion**
  Examples: Three generic examples of system consequence are: (parallel flow) a discrete distributed system with no constraint links, (identity flow) a constant distributed system with a single structure and identity constraint links, and (equivalencing) in the first-order logic institution.
  Summary: The theories of information flow and institutions are both abstract, with languages, sentences and structures being atomic. They are compatible: institutions generalize information flow, whereas information flow extends institutions. Information channels define the adjoint (direct/inverse) flow of information systems, with system consequence being the associated closure operator.